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| 10/649,697 | 08/28/2003 | Satoru Ohishi | 242158US3S | 6746 |

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| EXAMINER |
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BROOME, SAID A

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| ART UNIT | PAPER NUMBER |
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2628

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10/17/2007

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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|------------------------------|--------------------------------------|---------------------------------------|--|
| Office Action Summary | Application No. 10/649,697 | Applicant(s) OHISHI, SATORU | |
| | Examiner Said Broome | Art Unit 2628 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 11-15, 21 and 22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 11-15, 21 and 22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. This office action is in response to an amendment filed on 7/31/2007.
2. Claims 1-5, 11-15, 20 and 21 are original.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4 and 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Strobel (US Patent 6,650,724) in view of Mullick et al.(hereinafter "Mullick", US Patent 7,123,760).

Regarding claims 1 and 11, Strobel teaches that an apparatus acquires, and therefore stores, data of a plurality of mask and contrast images corresponding to a plurality of projection directions associated with an object to be examined (column 1 lines 12-14: "...3D *angio-volume reconstruction (volume reconstruction based on 2D projection exposures that are acquired with a C-arm apparatus...*" and in column 1 lines 52-55: "...*mask images, i.e. projection exposures without contrast image, as well as fill images...with contrast agent, are generated in a standard DSA exposure sequence.*"), where the DSA sequence uses a C-arm apparatus, which is known in the art to rotate in several directions, acquires several projections of mask and contrast images for generating the 3D imaging data sets (Figures 1 and 2). Strobel also teaches a subtraction unit

ΔV configured to generate data of a plurality of subtraction images by subtracting the plurality of mask images from the plurality of contrast images (column 2 lines 31-33: "...the mask image volume dataset V_1 is initially subtracted from the fill volume dataset V_2 ...", Figure 2). Strobel teaches a reconstruction unit configured to reconstruct first volume data from the plurality of contrast images (column 1 line 47: "...a 3D angio-volume dataset V_2 based on 2D fill images..."") and to reconstruct second volume data from the plurality of subtraction images (column 2 lines 31-34: "...the mask image volume dataset V_1 is...subtracted from the fill volume dataset V_2 ...the resulting difference volume ΔV ..."), where the subtraction volume is generated (Figure 2). Strobel also teaches generating data of a first 3D image representing a bone structure and/or a soft tissue for the mask volume data and to generate data of a second 3D image representing a contrasted blood vessel from the second volume data (column 1 lines 46-48: "...a 3D angio-volume dataset V_1 based on 2D mask images, and a 3D angio-volume dataset V_2 based on 2D fill images...", Figure 1), therefore the system of Strobel comprises one or more components that are functionally equivalent to the image processing unit. Strobel also teaches an image synthesizing unit (Figure 1) configured to generate data of a synthetic image by synthesizing the first 3D image with the second 3D image (column 2 lines 23-29: "...the volume datasets V_1 and V_2 are generated from the 2D mask images and the 2D fill images. The vessel tree [V_2] is...superimposed by addition with the mask image volume dataset $V_{sub.1}$ in order to obtain the ultimate volume dataset V_E ..."), therefore the system that outputs the synthesized image, must store the image data to memory, as recited in claim 11, in order to process and output the data, as known in the art. Strobel also illustrates outputting the synthetic image data (Figure 1 as V_E). However, Strobel fails to teach a second subtracting unit configured to

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generate mask volume data by subtracting second volume data containing vessels, from first volume data containing both bones structures and enhanced vessels, and a display unit. Mullick teaches generating mask volume data by subtracting images that contain only vessel data, or subtraction images, from images that contain both bone and vessel data, or contrast images, (column 13 lines 54-58: “...*the operator may be provided with the ability to increase or decrease the intensity...of the image in general or of certain parts of the image...in order to generate the desired rendering.*”), where specific image data within the volume rendered contrast data (Figure 15) may be removed, therefore the removal of particular data enables the vessel contained in the subtraction data (Figure 16) to be excluded (Figure 15) to produce an image of only the bone structure (column 12 lines 63-67), resulting in mask volume data. Mullick also teaches a display unit (column 4 lines 13-19) configured to display a an image containing both vessels and bone structures (Figures 7 and 15), therefore the display unit would be capable of displaying synthesized image data containing bone structures and blood vessels, as taught by Strobel. It would have been obvious to one of ordinary skill in the art at the time of invention to combine the teachings of Strobel with Mullick because this combination would provide realistic three dimensional images of captured mask or contrast images, where certain volumetric structures of the images, such as bone or tissue, may be displayed without obstruction from other vessels or obscurities and selectively presented to the user thereby providing accurate images free from distortions or undesired artifacts.

Regarding claims 2, 3, 12 and 13, Strobel fails to teach the limitations. Mullick teaches enabling certain regions of image data to contain an associated color (column 9 lines 48-58: “...*a reconstructed image that depicts an axial slice of an abdomen 70 including several bone regions*

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72, a vessel 74, as well as miscellaneous soft tissue 92...to simplify the presentation of material, actual slices will, of course, typically consist of a range of grey (or color) image intensities of various dynamic ranges.”), therefore certain regions, such as mask data, may be assigned a different color than other image data presented in the reconstructed image. The motivation to combine the teachings of Strobel with Mullick is equivalent to the motivation of claim 1.

Regarding claim 4 and 14, Strobel teaches generating the data of the first and second 3D images by volume rendering processing (column 1 lines 7-9: “...a 3D angio-volume reconstruction method for a three-dimensional subject based on 2D projection exposures.”), where the 3D images are rendered from a collection of 2D exposures or images.

Claims 5 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Strobel in view of Mullick in further view of Buzug et al.(hereinafter “Buzug”, US Patent 5,956,435).

Regarding claims 5 and 15, Strobel and Mullick fail to teach the limitations. Buzug teaches a display unit that enables a user to selectively display mask and contrast images (column 4 lines 64-67 – column 5 lines 1-7: “...memories 10, 11 and 12 serve to store the contrast image, the mask image and the difference image. An image...can be read from the memory 11 via the video control unit 7 and transferred to a display unit (monitor)...the user can fetch the various images or define image windows in the images.”), where the images may be three dimensional (column 8 lines 66-67 – column 9 lines 1-4: “The invention...can also be used for three-dimensional images which may have been formed by computer tomography or by an MR method; in that case the image sections to be compared are also three-dimensional...”). It would have been obvious to one of ordinary skill in the art at the time of invention to combine

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the teachings of Strobel, Mullick and Buzug because this combination would provide an interactive system that enables independent selection of mask and contrast images thereby saving display space and ensuring omission of undesired images.

Claims 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Strobel in view of Mullick and in further view of Klotz et al.(hereinafter "Klotz", US Patent 6,845,142).

Regarding claims 21 and 22, Strobel and Mullick fail to teach the limitations. Klotz teaches a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image (column 5 lines 44-56: "...geometrical distortions may occur if the X-ray image pick-up device includes an X-ray image intensifier which has a curved entrance screen and whose exit screen image may be influenced by the terrestrial magnetic field. In order to eliminate such distortions...the difference images $D_1...D_n$ are subjected to a geometrical transformation whose parameters have been determined and stored via a preceding calibration operation..."), where x-ray image data, which is the acquired mask or difference image data, and contrast images (column 4 lines 57-61: "After initialization (100) of the first imaging system and injection of a contrast medium, a series of n X-ray images is formed...which reproduce the object to be examined and the blood vessels which are present therein and filled with contrast medium..." and in column 5 lines 1-6: "...the images M are subtracted (step 102) from the corresponding contrast images, formed in the same angular position, so that there is formed a series of difference images $D_1,...D_i...D_n$ which reproduce only the vascular system for the various angular positions, because the other anatomic structures have been eliminated by the

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subtraction.”), are calibrated by using a regular grid, therefore containing vertical and horizontal lines in a rectangular form (Figure 2: step 103) where the corrected distortion results in a rectangular portion of the grid. It would have been obvious to one of ordinary skill in the art at the time of invention to combine the teachings of Strobel, Mullick and Klotz because this combination would provide improved image analysis of contrast images through an image calibration correction that reduces undesired artifacts that result from displaying contrast agents added to the blood vessels.

Response to Arguments

Applicant's arguments filed 7/31/07 have been fully considered but they are not persuasive.

The applicant argues on pg. 4 3rd ¶ lines 1-5 and on pg. 4 2nd ¶ lines 1-5 – 3rd ¶ lines 1-4 of the remarks that Mullick fails to teach a second subtracting unit configured to generate mask volume data (i.e. volume data containing bone structures), by subtracting second volume data (i.e. volume data containing vessels) from first volume data (i.e. volume data containing both bones structures and vessels), and that Mullick instead teaches how a bone mask may be displayed in varying degrees of opacity or translucence by adding or removing the bone mask from the display. However, varying the translucence of particular structures to enable exclusion of particular structures in the image, as taught by Mullick, is equivalent to subtracting second volume data (i.e. volume data containing vessels) from first volume data (i.e. volume data containing both bones structures and vessels) because specific image data within the volume rendered contrast data is subtracted (column 13 lines 54-58: “...*the operator may be provided*

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with the ability to...decrease...certain parts of the image...in order to generate the desired rendering.”), thereby resulting in functionally equivalent removal of particular data, such as the vessel contained in the image data containing both bone and vessel data (Figure 16) to produce mask volume data image of only the bone structure (column 12 lines 63-67: “The bone construct is comprised of...bone...and by excluding those regions determined to be vessel...”).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Said Broome whose telephone number is (571)272-2931. The examiner can normally be reached on M-F 8:30am-5pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571)272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Said Broome/

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10/6/07


ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER